



AD 750248

Technical Report: NAVTRAEQUIPCEN IH-207

AN EVALUATION OF THE TRAINING
EFFECTIVENESS OF DEVICE 2F90, TA-4J
OPERATIONAL FLIGHT TRAINER
PART I: THE B STAGE

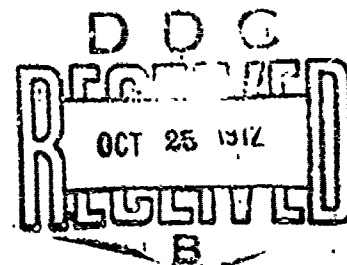
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August 1972

Naval Training Equipment Center
Orlando, Florida 32813
NAVTRADEVCCEN Task No. 1758-03

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Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified

1. ORIGINATING ACTIVITY (Corporate author) Naval Training Equipment Center Orlando, Florida 32813		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP	
3. REPORT TITLE AN EVALUATION OF THE TRAINING EFFECTIVENESS OF DEVICE 2F90			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final			
5. AUTHOR(S) (First name, middle initial, last name) Leonard E. Ryan, Joseph A. Puig, Gene S. Micheli, and James C. Clarke, CMDR, U.S. Navy			
6. REPORT DATE August 1972		7a. TOTAL NO. OF PAGES 53	7b. NO. OF REFS 3
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S) NAVTRAEQUIPCEN IH-207	
b. PROJECT NO 1758-03			
c.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.			
10. DISTRIBUTION STATEMENT Approved for public release; distribution is unlimited			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Human Factors Laboratory Naval Training Device Center Orlando, Florida	
13. ABSTRACT The training effectiveness of the TA-4J advanced jet trainer (Device 2F90) was evaluated by measuring transfer of training from the trainer to the operational situation. Comparisons were made among three experimental and a control group (which received the normal syllabus training). Of the experimental groups, one received training in flight, another group only in the trainer, and the third received only academic training on related principles of the basic instrument portion of the syllabus. Following training, all groups were given a checkride in the aircraft. The relative benefits of the different types of training were evaluated to determine the effectiveness of the trainer in training advanced naval aviation students in the B stage (Basic Instruments) of the NAVJIT (Naval Jet Instrument Trainer) syllabus for the TA-4J aircraft. The study demonstrated that 4.4 hours of aircraft flight time per student could be saved by substituting trainer time for aircraft time in the B stage; a significant cost savings when considering the 450 students that are processed through the school annually.			

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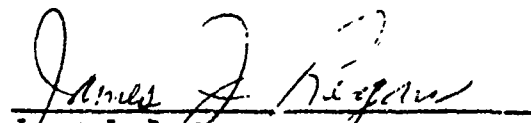
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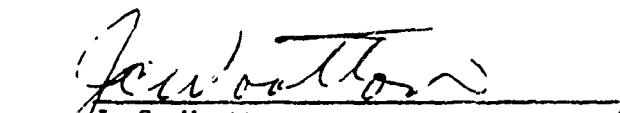
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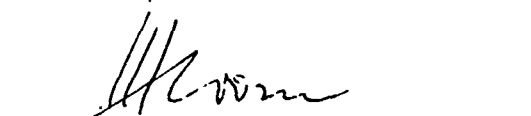
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ACKNOWLEDGEMENTS

The authors wish to express their appreciation to the trainer and flight instructors of the students who participated in this evaluation for their outstanding support and cooperation. The success of the study was due, in large measure, to the intense interest shown by the students and training personnel of Training Squadrons TWENTY-ONE, TWENTY-TWO, and TWENTY-THREE of the Naval Air Station, Kingsville.

We are especially grateful for the technical contributions and extensive assistance provided by Mr. John McIntyre, Mr. Dorsey Creedan and Lieutenant Andrew Deane Jr., of Device 2F90 Training Staff, and to Lieutenant Commander R. C. Glennon of Training Squadron TWENTY-THREE, without whose help this study could not have been accomplished.

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SECTION I

INTRODUCTION

The primary purpose of this study was to evaluate the training effectiveness of the TA-4J Operational Flight Trainer Device 2F90 located at the Naval Air Station, Kingsville, Texas.

This study is one in a series being conducted by the Naval Training Device Center to evaluate the effectiveness of major training devices. According to Jeantheau (1971), the evaluation of a device has two primary aspects: assessment of (1) the capabilities of the device itself and, (2) the effectiveness of the training offered on the device, that is, how the device is used. If the evaluation is to be of consequence, it should lead to recommendations for improvements which will increase the effectiveness of the entire training system. A related objective of these studies is to recommend ways of producing more cost-effective training procedures. The substitution of trainer time for time on the operational equipment is an excellent way of increasing cost-effectiveness. However, before substitution can be recommended, experimental evidence must be collected to determine (1) whether training using the device transfers to the operational situation and, (2) if transfer occurs, what trainer-to-flight ratio provides optimum results?

The present study was designed so that a comparison of the performance of pilots trained under one of four methods would answer the questions posed above. The study was limited to the B stage (Basic Instruments) portion of the NAVJIT Syllabus for the TA-4J aircraft. After completion of the B stage experimental program, feedback on student progress was derived from C stage (Instrument Navigation) performance, to assess the effects of different training methods upon later training and performance.

The first level of meaningful evaluation is a qualitative assessment of the device/situation. It does not involve measurement of any kind but is based on judgements made against a prior criteria. These criteria are cast in terms of characteristics of the device and the training situation that research and experience have shown to contribute to "effectiveness".

Most of the conclusions and recommendations made in this report were based on results from the transfer-of-training experiment. Additionally, though, a qualitative assessment was made, since it provides a systematic scheme for becoming familiar with the device and helps to assure that all the pre-evaluation information is obtained. The results of the qualitative assessment are shown in appendix C.

SECTION II

STATEMENT OF THE PROBLEM

The problem may best be stated in the form of the following questions:

- a. Is Device 2F90 an effective trainer? That is, does the behavior trained on the device result in positive transfer to the operational situation for which the training is intended?
- b. How much trainer time can be substituted for aircraft flight time without degrading training?
- c. What are the relative advantages of different methods of using the training device?

SECTION III

METHOD

THE TRAINING DEVICE

Device 2F90, which simulates the McDonnell Douglas TA-4J aircraft, was manufactured by the Goodyear Aerospace Corporation for the Naval Training Device Center. It is a multcockpit simulator comprised of four identical, but independently operated, cockpits and instructor stations. One centralized, general purpose, digital computer (XDS Sigma 5) activates all four training units.

The TA-4J Operational Flight Trainer was designed to train advanced student pilots in aircraft control, cockpit preflight and starting procedures, and normal and emergency procedures. In addition, navigational and instrument flight procedures, including field or carrier approach and landing procedures, are trained.

The trainee station is a highly realistic facsimile of the forward pilot's station of the aircraft. All controls and displays are identical in appearance and operation to those of the actual aircraft. A cockpit motion system provides three degrees of motion: pitch, ± 15 degrees; roll, ± 15 degrees; and vertical translation, ± 6 inches.

The overall configuration of Device 2F90 is shown in Figure 1. A more thorough description of the Device and its technical features may be found in NAVTRADEVGEN P-3569, Utilization Handbook for TA-4J Aircraft Operational Flight Trainer, Device 2F90, dated 1 July 1970.

THE TRAINING PROGRAM

The syllabus currently in use in the Advanced Jet Phase provides a series of exercises covering several stages of training. The entire program requires 20 weeks and is subdivided as shown in Table 1. At the present time, Device 2F90 is used to teach cockpit familiarization and emergency procedures in the FP stage, basic instruments in the B stage, and instrument navigation in the C stage. A NAVJIT-5 Profile Mission is given in the training device after the B-4 flight. The student is graded on this exercise in the same fashion as in the B-6 in-flight checkride; that is, by means of instructor grading of performance in accordance with check lists. A sample Aviation Training Jacket (ATJ) check list is shown in Appendix A. During the trainee Profile Mission, the instructor grading is supplemented by a computer recording system.

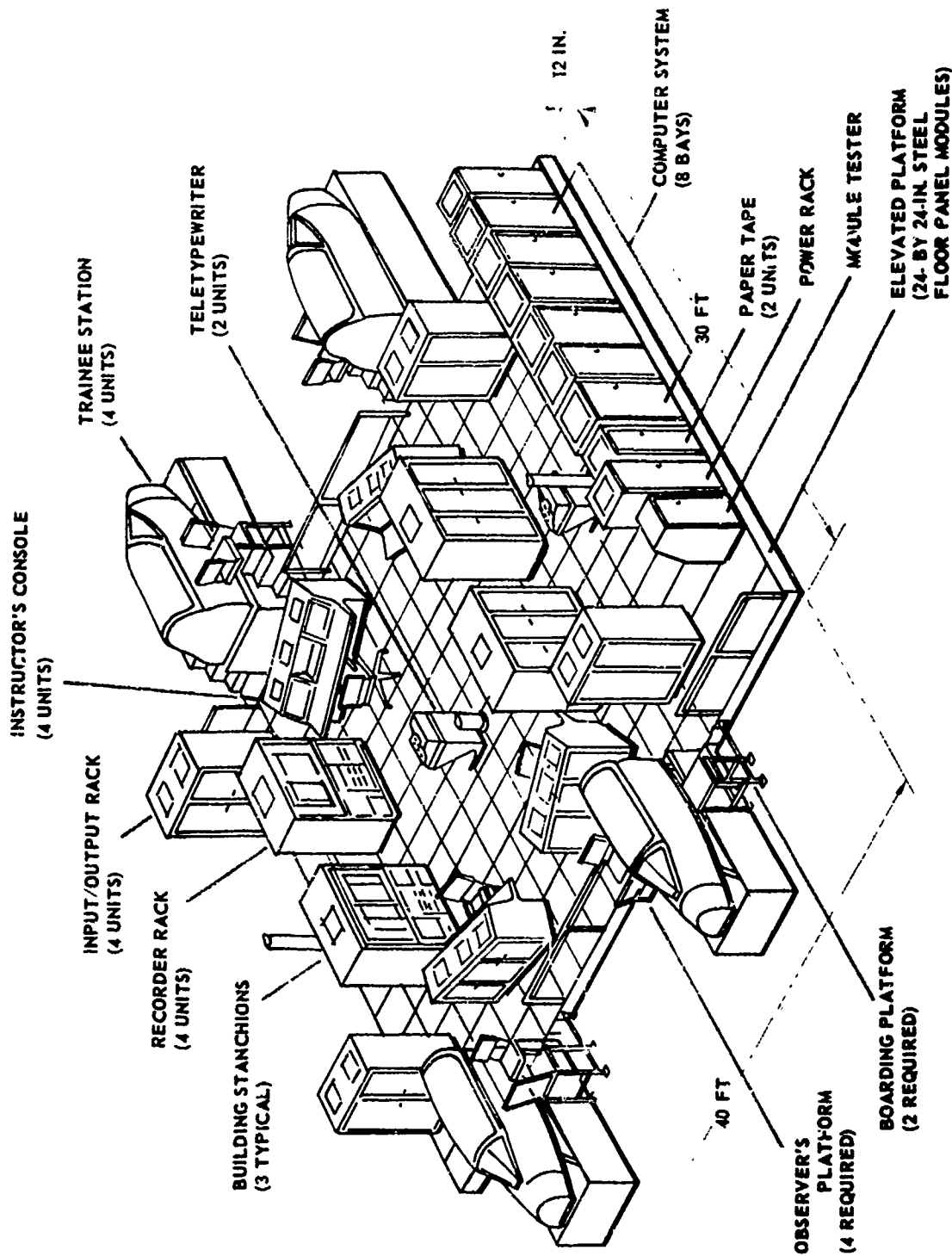


Figure 1. TA-4J Operational Flight Trainer, Device 2F90

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TABLE 1. ADVANCED JET TRAINING PHASE (20 WEEKS)

Stage	Topic	2F90 Hrs.	Flt. Hrs.
FP	Flight Procedures	8	
A	Familiarization		11
B	Basic Instruments	8	8
C	Instrument Navigation	32	36
E	Formation		13
F	Night Flying		9
G	Operational Navigation		9
H	Applied Instrument Navigation		5
I	Air-To-Ground Weapons		12
J	Tactics		10
K	Air-To-Air Weapons		4
L	Carrier Qualifications		12
TOTAL		48	129

The A stage is a familiarization stage consisting of eight flights in the TA-4J Aircraft of 1.4 hours duration each. Solo flights A-6, A-7, and A-8, are given after C-13. Students, therefore, do not solo until after they have received a substantial amount of instrument navigation training in C stage.

The standard syllabus is designed to alternate ("sandwich") the flight and trainer sessions during the B and C stages. Under that curriculum it would be difficult to determine how much of the training was contributed by Device 2F90 and how much by in-flight training in the TA-4J Aircraft. To isolate the effects of the trainer, some manipulation of the curriculum was necessary.

EXPERIMENTAL DESIGN

The effectiveness of Device 2F90 for training was evaluated by comparing performance in the operational situation (i. e., an in-flight checkride) of groups given different training regimes. Three experimental groups were compared to each other and to a control group (C) which had received the standard syllabus training. Of the three experimental groups, one received training in the TA-4J only (F), another group was trained in the 2F90 only (T) and the third received only academic training (A) on related principles of the basic instrument portion of the syllabus (syllabi for B stage and academic training is shown in Appendix B.) All groups were then given a B-6 flight check in the TA-4J. Following the B-6 flight check, trainees from the experimental groups were

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recycled (in the aircraft and/or the trainer) for as many flights as was judged by the instructors to be necessary to make them as proficient as the control group. The experimental design is shown in Table 2.

TABLE 2. EXPERIMENTAL DESIGN

Training Received	GROUPS			
	Control	Flight N=30	Trainer N=33	Academic N=31
Emergency Procedures 2F90	8	8	8	8
Flight A-Stage	7	7	7	7
Principles Training				7
Basic Inst-Flight	7*	7		
Basic Inst-2F90	5.6*		7	
Checkride 2F90	1.4*		1.4	
Checkride Flight	2.0*	2	2	2
Checkride 2F90		1.4		1.4
TOTALS IN HOURS	31.0	25.4	25.4	25.4

* Flight and Trainer sessions are alternated for Control Group as follows: SIT 1, SIT 2, B1, SIT 3, B2, SIT 4, B3, SIT 5, B4, B5, B6

After completing the B stage training, all subjects went through the regular C stage curriculum.

The data for analysis consisted of the ATJ's for all training checkride and recycle sessions in the TA-4J and the 2F90. Additionally, strip chart recordings and plot charts were made of the 2F90 profile sessions but it is expected that analysis of that data will be completed at a later date and be published as an addendum to this report.

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Specifically, the study yielded the following information:

- a. measures of the transfer of training in terms of the number of flights saved
- b. effects of initial training upon performance in C stage
- c. comparison of instructor and automatic recording features
- d. relationship between flight and 2F90 performance
- e. data for the manipulation of subsequent training emphasis
- f. a basis for the design of possible future experiments

SUBJECTS

All subjects had recently completed Basic Flight Training and all except three received their training in T2 jets. The three remaining were trained in the T28 aircraft. The Ss of all four groups were matched on the basis of their undergraduate pilot training scores.

SECTION IV

RESULTS

INTRODUCTION

Performance, training time and recycle hops for the different types of training were analyzed to determine their relative effectiveness. The experimental groups were compared as follows:

- a. Performance on B6 flight check
- b. Performance on NAVJIT 6 trainer check
- c. Training and/or aircraft recycle hops
- d. Total training hours per student in B Stage
- e. Total training hours per student in C Stage
- f. Performance in C Stage
- g. B and C stage performance with NAMI (Naval Aeromedical Institute) norms

TRAINING, TESTING AND RECYCLE SESSIONS

The training, testing and recycle sessions for individual students are shown in Table 3. This table is included to present an overall view of all training and testing sessions for individual students. For example: student no. 1 of the T Group received five training sessions in the 2F90, a test session in the 2F90 which he passed, a B6 flight check in the TA-4J which he also passed, one recycle session in the 2F90 and three recycle sessions in the TA-4J. In general, most students in the T Group progressed in a similar fashion.

The fact that it was possible for students to pass either or both the 2F90 and TA-4J test hops and yet require additional training indicates that the test scores of students did not reflect adequately the instructor judgements. This, of course, brings up the question of validity of the test data. This question is best answered by pointing out that analysis of the data, where appropriate, took into consideration all recycle sessions of students. Stated differently, this means that students were evaluated as to (1) how well they did on their TA-4J flight check and (2) how many total hours of training they received before attaining judged proficiency and progressing to the C stage. Actual hours of flight time in the B stage tended to be a better indicator of overall student performance than was a score from a single test hop.

TABLE 3. TRAINING, TESTING AND RECYCLE SESSION - TRAINER GROUP

STUDENT	2F90 SESSIONS						B6 FLIGHT CHECK		2F90						RECYCLED SESSIONS						TA - 4J							
							P	F																				
	1	2	3	4	5	6			1	2	3	4	5	6	1	2	3	4	5	6	7	8						
1	X	X	X	X	X	X	X		X						X	X	X				X	X	X					
2	X	X	X	X	X	X		X							X	X	X				X	X	X					
3	X	X	X	X	X	X		X							X	X	X				X	X	X					
4	X	X	X	X	X	X									X	X	X				X	X	X					
5	X	X	X	X	X	X		X							X	X	X				X	X	X					
6	X	X	X	X	X	X		X							X	X	X				X	X	X					
7	X	X	X	X	X	X		X							X	X	X				X	X	X					
8	X	X	X	X	X	X		X							X	X	X				X	X	X					
9	X	X	X	X	X	X		X							X	X	X				X	X	X					
10	X	X	X	X	X	X		X							X	X	X				X	X	X					
11	X	X	X	X	X	X		X							X	X	X				X	X	X					
12	X	X	X	X	X	X		X							X	X	X				X	X	X					
13	X	X	X	X	X	X		X							X	X	X				X	X	X					
14	X	X	X	X	X	X		X							X	X	X				X	X	X					
15	X	X	X	X	X	X		X							X	X	X				X	X	X					
16	X	X	X	X	X	X		X							X	X	X				X	X	X					
17	X	X	X	X	X	X		X							X	X	X				X	X	X					
18	X	X	X	X	X	X		X							X	X	X				X	X	X					
19	X	X	X	X	X	X		X							X	X	X				X	X	X					
20	X	X	X	X	X	X		X							X	X	X				X	X	X					
21	X	X	X	X	X	X		X							X	X	X				X	X	X					
22	X	X	X	X	X	X		X							X	X	X				X	X	X					
23	X	X	X	X	X	X		X							X	X	X				X	X	X					
24	X	X	X	X	X	X		X							X	X	X				X	X	X					
25	X	X	X	X	X	X		X							X	X	X				X	X	X					
26	X	X	X	X	X	X		X							X	X	X				X	X	X					
27	X	X	X	X	X	X		X							X	X	X				X	X	X					
28	X	X	X	X	X	X		X							X	X	X				X	X	X					
29	X	X	X	X	X	X		X							X	X	X				X	X	X					
30	X	X	X	X	X	X		X							X	X	X				X	X	X					
31	X	X	X	X	X	X		X							X	X	X				X	X	X					
32	X	X	X	X	X	X		X							X	X	X				X	X	X					
33	X	X	X	X	X	X		X							X	X	X				X	X	X					

TABLE 3. TRAINING, TESTING AND RECYCLE SESSION - FLIGHT GROUP (Cont)

STUDENT	TA-4J SESSIONS						2F90						RECYCLED SESSIONS						TA-4J							
	CHECK						2F90						RECYCLED SESSIONS						TA-4J							
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	7	8
1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
23	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
24	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
26	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
27	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X Student undertook session twice

TABLE 3. TRAINING, TESTING AND RECYCLE SESSION - ACADEMIC GROUP (Cont)

STUDENT	Academic Training 7 HRS	B6 FLIGHT CHECK		2F90 CHECK		RECYCLED SESSIONS															
						2F90				TA - 4J											
		P	F	P	F	1	2	3	4	5	6	1	2	3	4	5	6	7	8		
1	X		X	X		X	X					X	X								
2	X		X	X		X	X		X			X	X		X	X	X				
3	X		X	X		X	X		X			X	X		X	X	X				
4	X		X	X		X	X			X		X	X								
5	X	X		X		X	X					X	X		X						
6	X		X	X		X	X					X	X		X	X	X				
7	X		X	X		X	X					X	X		X						
8	X		X	X		X	X					X	X		X						
9	X		X	X		X	X					X	X		X						
10	X		X	X		X	X					X	X		X	X	X				
11	X		X	X		X	X					X	X		X						
12	X		X	X		X	X					X	X		X	X					
13	X		X	X		X	X					X	X		X	X					
14	X		X	X		X	X					X	X		X						
15	X		X	X		X	X					X	X		X						
16	X		X	X		X	X					X	X		X						
17	X		X	X		X	X					X	X		X						
18	X		X	X		X	X					X	X		X						
19	X		X	X		X	X					X	X		X						
20	X		X	X		X	X					X	X		X						
21	X		X	X		X	X					X	X		X						
22	X		X	X		X	X					X	X		X						
23	X		X	X		X	X					X	X		X						
24	X		X	X		X	X					X	X		X						
25	X		X	X		X	X					X	X		X						
26	X		X	X		X	X					X	X		X						
27	X		X	X		X	X					X	X		X						
28	X		X	X		X	X					X	X		X						
29	X		X	X		X	X					X	X		X						
30	X		X	X		X	X					X	X		X						
31	X		X	X		X	X					X	X		X						

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On the average each session of Table 3 represents 1.4 hours of time in the 2F90 or TA-4J. After initial training and testing, Group A required 3.8 additional hours per student in the 2F90 and 5.2 additional hours per student in the TA-4J to attain proficiency level whereas Group T required only .3 additional hours per student in the 2F90 and 2.5 additional hours per student in the TA-4J to attain proficiency level. Group F received .65 additional hours per student in the 2F90 and .23 additional hours per student in the TA-4J. The total training hours for all groups are shown in Table 4.

TRAINING HOURS AND PERFORMANCE IN B STAGE

Table 4 shows the training hours per student in the B stage and the number of flight and trainer hours saved by the experimental groups as compared to the control group. The flight hours and trainer hours include training, testing and recycling sessions for all trainees including 10 flight hours received by Group A and 7 flight hours by Group T which occurred as a result of several students being required to take a B stage hop after they had completed the B stage training and had entered C stage training. These extra sessions were imposed to correct some specific deficiency in only a few students.

TABLE 4. TRAINING HOURS/STUDENT
IN B STAGE

	C	F	T	A
Flight Hours	8.5	8.8	4.1	6.7
Trainer Hours	7.1	2.1	8.7	5.2
Flight Hours Saved	-	-.3	4.4	1.8
Trainer Hours Saved	-	5.0	-1.6	1.9

The following charts (Figures 2 and 3) show a comparison across groups of mean trainer check scores, percentage of students passing the trainer check, mean flight check scores and percentage of students passing the flight check. Also shown in Figure 3 are the mean scores (of all aircraft flights) of the students from groups T and A after recycling; 3.03 and 2.99 respectively. Mean scores were used here because no formal B6 test was given to students who were recycled.

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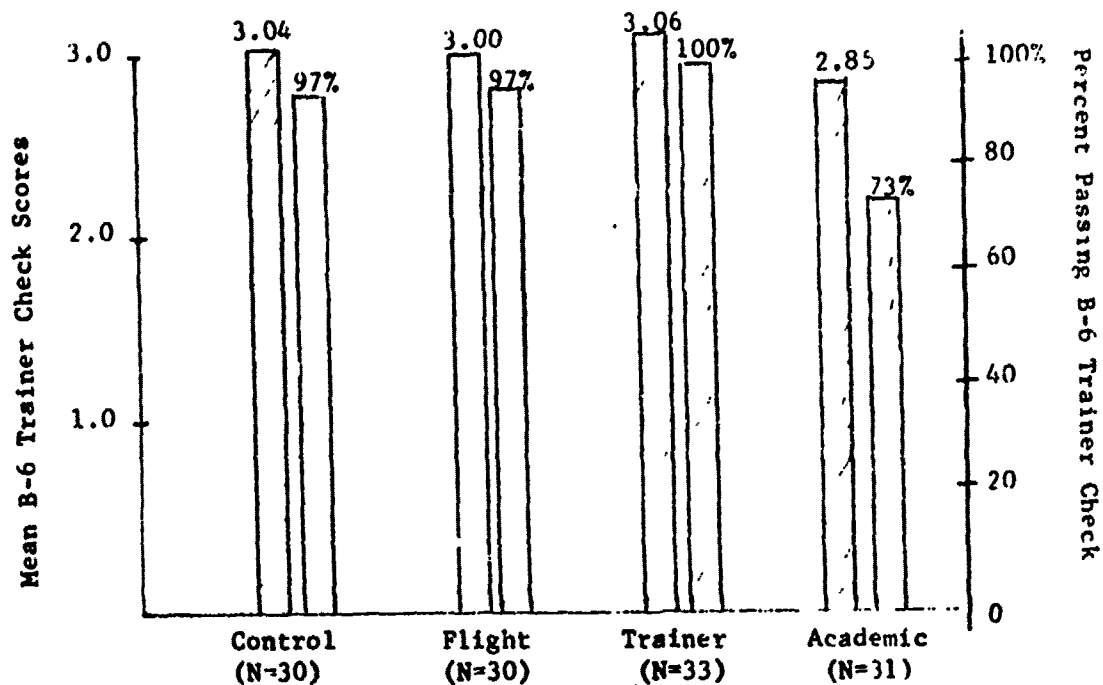
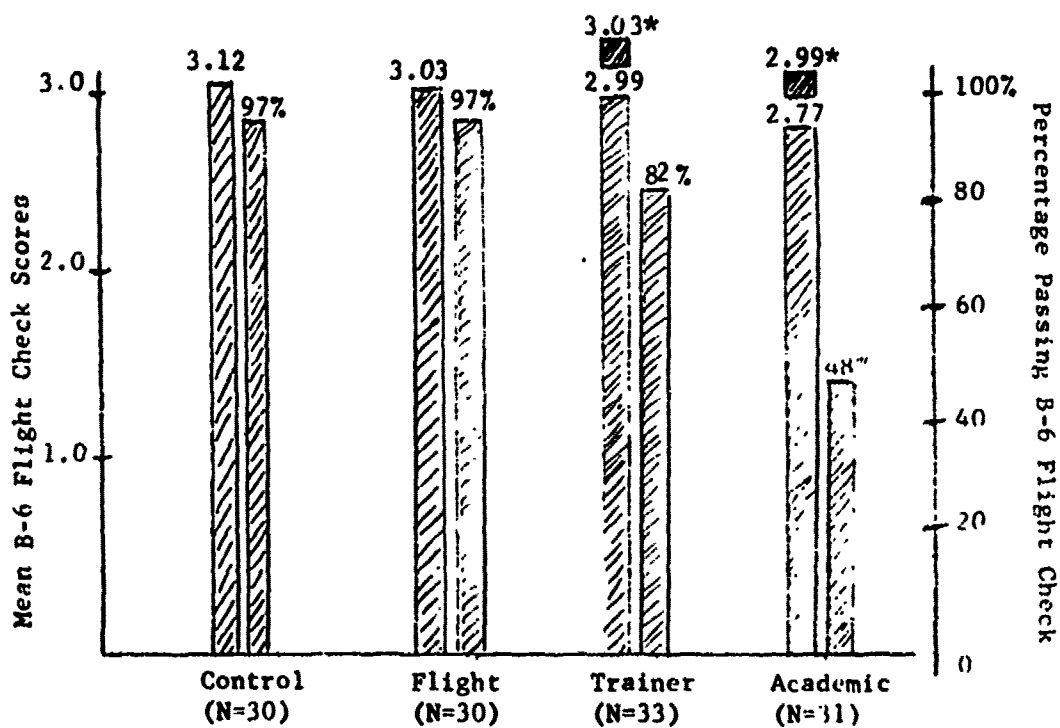


Figure 2. Performance on 2F93 Trainer Check



* After recycling

Figure 3. Performance on TA-4J Flight Check

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FLIGHT PERFORMANCE SCORES OF RECYCLED AND NON-RECYCLED STUDENTS

Table 5 is a listing of B6 flight check scores of non-recycled trainees and the mean flight scores of the recycled trainees as well as their performance in the C stage.

TABLE 5. COMPARISON OF FLIGHT PERFORMANCE SCORES OF RECYCLED AND NON-RECYCLED STUDENTS OF ACADEMIC GROUP

<u>Non Recycled</u>	<u>B6 Flight Check</u>	<u>C Stage Avg.</u>	<u>Recycled</u>	<u>Avg. of Recycled Flts. Excluding B6 Flight Check</u>	<u>C Stage Avg.</u>
#1	3.24	3.11	#1	3.42	3.08
#2	3.21	3.14	#2	3.22	3.17
#3	3.18	3.06	#3	3.18	3.11
#4	3.15	3.13	#4	3.16	3.07
#5	3.11	3.02	#5	3.16	3.04
#6	3.08	3.03	#6	3.15	3.16
#7	3.00	3.10	#7	3.14	3.13
#8	3.00	3.16	#8	3.14	3.11
#9	3.00	2.94	#9	3.14	3.13
#10	3.00	3.13	#10	3.05	3.05
#11	2.89	3.09	#11	3.04	3.04
			#12	3.03	3.11
			#13	3.02	3.07
AVG	3.08	3.08	#14	3.00	3.08
			#15	3.00	3.09
			#16	3.00	3.06
			#17	2.96	3.03
			#18	2.96	3.03
			#19	2.92	3.02
			#20	2.86	2.95
			#21	2.77	3.02
			#22	3.75	2.99
			AVG	3.07	3.07

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TABLE 5. COMPARISON OF FLIGHT PERFORMANCE SCORES OF RECYCLED AND CON-RECYCLED STUDENTS OF ACADEMIC GROUP (C)

<u>Non Recycled</u>	<u>B6 Flight Check</u>	<u>C Stage Avg.</u>	<u>Recycled</u>	<u>Avg. of Recycled Flts. Excluding B6 Flight Check</u>	<u>C Stage Avg.</u>
#1	3.06	3.15	#1	3.20	3.11
#2	3.04	3.05	#2	3.19	3.05
#3	3.00	3.04	#3	3.14	3.10
#4	2.94	3.03	#4	3.14	3.07
			#5	3.13	3.11
			#6	3.13	3.10
AVG	3.01	3.07	#7	3.12	3.11
			#8	3.12	3.08
			#9	3.11	3.04
			#10	3.11	3.11
			#11	3.10	3.04
			#12	3.09	3.07
			#13	3.08	3.07
			#14	3.07	2.98
			#15	3.07	3.10
			#16	3.06	3.02
			#17	3.06	3.09
			#18	3.05	3.01
			#19	3.04	3.04
			#20	3.03	3.09
			#21	3.03	3.03
			#22	3.03	3.00
			#23	3.01	3.09
			#24	2.99	3.04
			#25	2.98	2.98
			#26	2.97	3.06
			#27	2.96	2.99
			AVG	3.07	3.06

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The data shown in Table 6 are scores made by individual trainees from the F and T groups during the B-6 test in the TA-4J.

TABLE 6. B-6 TEST SCORES OF INDIVIDUAL TRAINEES

<u>Flight Group</u>	<u>Trainer Group</u>
3.36	3.24
3.22	3.21
3.19	3.18
3.15	3.15
3.12	3.11
3.11	3.08
3.06	3.06
3.06	3.06
3.06	3.05
3.05	3.05
3.05	3.05
3.05	3.05
3.05	3.05
3.05	3.00
3.05	3.00
3.05	3.00
3.04	3.00
3.00	3.00
3.00	3.00
3.00	3.00
3.00	3.00
3.00	3.00
3.00	2.89
2.96	2.89
2.95	2.88
2.94	2.88
2.90	2.86
2.89	2.84
2.85	2.75
2.83	2.75
	2.67
	2.55
	2.50

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NAVAL AEROMEDICAL INSTITUTE (NAMI) NORMATIVE DATA

Undergraduate and advanced training normative data provided by NAMI is presented in Table 7. The data is based upon the performance of approximately 731 students during the last half of calendar year 1970 and all of 1971.

TABLE 7. COMPARISON OF NAMI NORMATIVE DATA WITH CONTROL AND EXPERIMENTAL GROUP DATA

	<u>NAMI</u>	<u>Control</u>	<u>Flight</u>	<u>Tra</u>	<u>Academic</u>
Basic Flight	53.2	52.2	52.5	52.4	52.4
B Stage Avg.	3.10	3.09	3.07	3.03	2.99
B Stage Recycled Flight Avg.*				3.07	3.07
C Stage Avg.	3.07	3.08	3.08	3.07	3.06
*Excludes the B6 Flight Test					

TRAINING HOURS AND PERFORMANCE IN C STAGE

Although C stage training was not directly involved in this study some data were collected and analyzed to assess the effects of different training methods on C stage performance. The results are shown in Table 8.

TABLE 8. C-STAGE TRAINING HOURS/STUDENT

	<u>C</u>	<u>F</u>	<u>T</u>	<u>A</u>
Flight Hours	26.74	27.02	27.15	26.27
Average Grade	3.08	3.08	3.07	3.06*
*Significantly different from C Group $Z = 1.71, p < .05$				

DISCUSSION OF RESULTS

From Table 4 it can be seen that both the trainer and academic groups achieved a savings in flight hours; 145 hours (4.4 X N of 33) for the trainer group and 56 hours (1.8 X N of 31) for the academic group. This finding is particularly revealing when considering the data from Figure 3 which shows that for groups C, F, T and A the mean scores on the B6 flight check were 3.12, 3.03, 2.99 and 2.77 respectively. The control group was significantly higher ($P = < .05$) than all other groups. There was no statistical significance between the flight group and the trainer group. ($\bar{z} = 1.15$, $P > .12$). A significant difference was found between the trainer group and the academic group. ($\bar{z} = -3.93$, $P < .001$).

Instructor pilots were quick to point out that they could distinguish between a "2.99" and a "3.03" pilot. Apparently they could, and probably for that reason some students from both the T and A groups were recycled until they met a judged proficiency level. It was mentioned earlier in this report (Section III, Experimental Design) that students from all three experimental groups were recycled for as many training sessions as deemed necessary by the instructor pilots to make them as proficient as the control group. However, it should be taken into consideration that the scores of 2.99 and 3.03 represent group means and that average scores of groups can sometimes be misleading. For example, only five of the T group trainees scored lower than all of the F group trainees and only one of the trainees in the F group scored higher than all of the trainees in the T group. (See Table 6). In other words, on a score by score comparison the two groups were not that different.

Shown in Figure 3 are the mean scores (of all aircraft flights) of the students from groups T and A after recycling; 3.03 and 2.99 respectively. Mean scores were used here because no formal B6 test was given to students who were recycled.

These data, however, do not take into consideration differences between students who were recycled and those who were not. Table 5 provides this information. For group T, the average score of students who passed ($N = 11$) the B6 flight test and received no further aircraft time, was 3.08. The remaining students in group T ($N = 22$) who were recycled in the aircraft, and in some cases the trainer too, had an average grade of 3.07 on the recycled hops. (The B6 test hop was not included as a recycle hop).

These data point out that students from group T were flying at a proficiency level of 3.07 or higher upon entering C stage training. For group A, the non-recycled students ($N = 4$) had an average of 3.01 upon entering the C stage and the recycled students ($N = 27$) had an average of 3.07.

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Since 3.07 represents the mean performance level of students from groups F and T on all recycled flights, it was felt that this score was representative of their actual performance level upon entering C stage training.

Apparently the flight instructors did an excellent job in deciding when a student was ready for advancement. Of sixty four students in the T and A experimental groups, sixty were flying at a skill level of 3.07 or higher before advancing to the C stage.

A look at the performance of recycled vs non-recycled students in the C stage is interesting. Referring again to Table 5, the non-recycled students of group T averaged 3.08 during the C stage and the recycled group averaged slightly less; 3.07. For group A, the non-recycled students averaged 3.07 and the recycled students averaged 3.06. It seems that the better students, i. e., those who did not require recycling, scored higher, although not significantly, in the C stage than did recycled students. No significant differences were found between the T group and other groups but significant difference was found between groups F and A ($\bar{z} = 1.71$, $P < .05$).

Why the academic group scored significantly different from the control and flight groups in the C stage is not known. It cannot be explained on the basis of too little aircraft time in the B stage since they had more hours than the trainer group whose performance in the C stage was not significantly lower than the C or F groups. Also, upon entering C stage training they were flying at the same skill level as the F and T groups. And finally, although they had an average of 3.5 hours less time in the trainer than the T group, they had 2.6 hours more in the aircraft.

It can be noted in Table 7 that the NAMI B stage means are higher than all of the groups involved in the study but the NAMI C stage means are higher than only the A group. Tests of significance could not be made with the NAMI data since performance scores of individuals were not available. Also presented in Table 7 are two sets of B stage data for the T and A groups. One set is the average of all B stage flights which is made up of the B6 test and all recycled flights. The second set is the average of all B stage flights excluding the B6 test. As mentioned above, the mean performance on the recycled flights was considered to be more indicative of skill level than was either the single B6 flight check or the B stage average. Hence the more appropriate comparison would be 3.09 of the control group with 3.07 of the F, T, and A groups. These comparisons show no significant differences.

In summary then, no significant differences exist between groups F and T when compared on either the B6 test or the B stage average. (As stated above, the average of the recycled hops was used for the T group).

SECTION V

CONCLUSIONS

Based upon analysis of the study data, the following conclusions were made.

a. Training students by the methods used for the Trainer and Academic groups will result in a significant savings in flight hours. (This conclusion is made with the assumption that students will be recycled as necessary to meet instructor judged proficiency skill levels).

b. Students trained under the "Trainer method" will successfully complete the B and C stages of training with mean scores not significantly different from either the Control or Flight groups.

c. Students trained under the "Academic method" will score significantly lower on the B6 flight test than the Control, Flight and Trainer groups and will require more recycling time in both the trainer and aircraft than the F and T groups in order to attain proficiency level. They also will score significantly lower (mean average grade) in the C stage than the C, F and T groups.

D. Training in the use of TA-4J Basic Instruments can be accomplished effectively by substituting six Device 2F90 hops for three of six TA-4J hops.

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SECTION VI

RECOMMENDATIONS

The findings of this study should be validated before any changes in the present training program are recommended.

A similar evaluation of the combined B and C stages should be conducted.

An experimental design to determine an optimal trainer-to-flight ratio should be used in future evaluations.

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REFERENCES

Jeantheau, G. G. Handbook for Training System Evaluation.

Technical Report: NAVTRADEVCEEN 66-C-0113-2, January 1971.

NAVTRADEVCEEN P-3569, Utilization Handbook for TA-4J Aircraft
Operational Flight Trainer, Device 2F90, 1 July 1970.

CNAVANTRAINST 1542.12A, TA-4 Advanced Jet Syllabi, 21 Jan 1970.

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APPENDIX A

SAMPLE AVIATION
TRAINING JACKET (ATJ)

NAVTRA EQUIPCEN IH-207

TS-2/TF-9 BASIC INSTRUMENTS (ATJ)
CNATRA-GEN 1542/51 (Rev. 4-67)

1. Use number 2 lead pencil only.
2. To avoid machine error any erasures must be neat and clean.

PILOT NUMBER										INSTRUCTOR NUMBER									
<div style="display: flex; justify-content: space-between;"> 1234567890 </div>										<div style="display: flex; justify-content: space-between;"> 0123456789 </div>									
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NAVTRABQUIPCEN IH-207

APPENDIX B

SAMPLE ACADEMIC GROUP
TRAINING SYLLABUS AND
REGULAR B STAGE SYLLABUS

ACADEMIC GROUP SYLLABUS

These instructions are being written for the benefit of the advanced student, and not for the basic student. Corrective information to improve instrument flying, and suggestions contained herein, are the result of years of teaching experience, and the study of the more prominent weaknesses of the advanced students at this station. It is hoped that through your study of the information contained herein you will be able to improve your knowledge and techniques of Basic Instrument Flying.

COMPONENTS OF ATTITUDE INSTRUMENT FLYING

Attitude instrument flying consists of three major components: (1) instrument coverage, (2) instrument interpretation, and (3) aircraft control.

INSTRUMENT COVERAGE

Instrument coverage is commonly termed "scan" (cross-checking). In view of looking at today's aircraft, with its million and one things to do while in flight, I believe a different term could be substituted here, at least a term implying a different meaning. I like the term "viewing", for this has a different value to me. In the past, I have explained "viewing" to students in this way: "Look at the instrument panel the same way that you look at the road when driving an automobile. If you had to depend on looking to the right and left in order to detect 'side dangers', as one does when he has what is called 'pipe line' vision, driving would be much more dangerous than when one has full vision, and uses the 'corners' of his eyes, as we all do in everyday driving." Now, instrument flying can be done much in the same way. This can be accomplished by sitting back as far from the instruments as possible. This becomes a more

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difficult problem when under the "bag" in the F9J if you are taller than average, for the "bag" has a definite tendency to force you to sit forward. This is a handicap that the taller students will have to overcome in the best way possible. The farther one can get from the instrument panel, while flying, the more he will be able to see, and the easier it becomes. As you look over the instrument panel, use the "corners" of your eyes to detect instrument changes. This sounds easy, but one who has depended on going from one instrument to another, will find this hard to do at first. In fact, you may find that this system becomes almost impossible to do at first, and will give up trying almost immediately. However, if you will strive to use this method, your proficiency will improve, allowing you to relax much more under instrument conditions, and your instrument flying will improve considerably.

Another thing that will help you is to know the power settings for the various maneuvers, and to know how much throttle movement it takes to arrive at this setting. This particular item has been dealt with entirely too lightly in the past. This will save you from "staring" at the tach during a power change, and neglecting the other instruments while you adjust the throttle.

It has long been known that pilots do not scan (cross-check) the instruments in any specific sequence. They do, however, follow definite rules concerning the instrument(s) to be observed closely, during any particular maneuver. For each maneuver of flight condition, there are certain instruments that give the best and most reliable information concerning the attitude of the aircraft. For level flight, observe the altimeter to determine if the desired altitude is being maintained. In

a climb at a given airspeed, watch the airspeed indicator closely. This instrument, which gives the most pertinent pitch information, is referred to as the "primary pitch instrument" for this particular maneuver. Cross-check the remaining instruments continually throughout the maneuver to aid in keeping the primary instrument(s) at the proper indications.

Instruments used for this purpose are referred to as supporting instruments. This system of primary and supporting instruments is known as the Primary Instrument System of cross-checking. Experiments conducted by the Aero-Medical Laboratory at Wright Field have proved that all pilots use this system of cross-checking. In fact, it has found that the more experienced pilots were able to utilize the Primary Instrument System to a better advantage than the less experienced pilots. The results of these experiments have also proved that a thorough understanding of the Primary Instrument System will enable the pilot to develop a better individual cross-check and prevent the formation of useless and time-wasting habits.

THE PRIMARY INSTRUMENT IS ALWAYS THE ONE THAT GIVES THE MOST PERTINENT OR RELIABLE INFORMATION CONCERNING THE DESIRED CONDITION OF FLIGHT, AND IS USUALLY THE ONE THAT SHOULD BE HELD AT A CONSTANT INDICATION.

For any maneuver or part of a maneuver, there is a designated primary pitch instrument, a primary bank instrument, and a primary power instrument. The altimeter is always the primary pitch instrument in level flight, except in thunderstorms where strong vertical air currents and pressure changes tend to make the altimeter unreliable. In this case, and in other cases, when the primary instrument fails to give the correct indication, supporting instruments must be used. There are times when

you will observe a supporting instrument as often, if not more often, than the primary instrument.

INSTRUMENT INTERPRETATION

The second major component in attitude instrument flying is instrument interpretation, which usually is difficult to learn. Proper instrument interpretation contributes to efficient instrument flying techniques. Some instruments are harder to interpret than others. The first step in becoming proficient in instrument interpretation is learning the construction and principle of operation of each flight instrument. This reduces the difficulty of learning to use the instruments, and it usually results in higher instrument proficiency. For example: if the position of the nose is to be determined, the airspeed indicator, the altimeter, the vertical speed indicator, and the artificial horizon must be interpreted. Likewise, if the position of the wings is to be determined, the indications of the artificial horizon, the heading indicator, and the needle and ball must be interpreted. These interpretations should be interpreted in terms of the attitude of the aircraft at all times.

AIRCRAFT CONTROL

The third and final component of attitude instrument flying is aircraft control. The main cause for shortcomings here, is that almost every student, without exception, overcontrols, by using too much stick pressure and movement. These students are termed as "soup stirrers" and "cement mixers." Using this method can certainly be termed as "the hard way of doing it." Another problem the student "manufactures" is

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that he gets a "death grip" on the stick, which causes tenseness and this results in applying unnecessary stick pressures. This contributes to erratic control, which results in poor instrument flying. To eliminate this, "handle" the stick lightly, using only the thumb and a couple of fingers, and rest the arm on the leg, in order to keep false pressures off the stick.

The importance of proper trim in high speed flight cannot be over-emphasized. Because of the control sensitivity of high speed aircraft, any out-of-trim condition will make it very difficult to maintain the desired flight condition. The trim controls, being conveniently located, are easy to use. However, make no attempt to fly the aircraft with trim alone. Place the aircraft in the desired pitch attitude and relieve all pressure on the controls with the trim. Never trim an aircraft into an ordinary maneuver, or into a corrected attitude. Do not trim in turns, unless you intend to continue the turn for a long duration, for you lose the feel of the aircraft, and this will result in using greater effort and concentration, in order to maintain a smooth and accurate maneuver, DO NOT TRIM EXCESSIVELY. If a pilot attains good instrument flying techniques and abilities in one aircraft, he can fly by instruments satisfactory in any type of aircraft in which he has attained adequate flying proficiency. Instrument flying, then, is essentially visual flying, using instruments.

PITCH CONTROL FOR LEVEL FLIGHT

The pitch attitude of an aircraft is the angular relation of the longitudinal axis of the aircraft to the true horizon. In flight, the pitch attitude required to maintain any desired condition (climb, descent,

or level flight) is the result of the simultaneous effect of three variable factors; airspeed, altitude, and load conditions. As the airspeed is changed, the angle of attack or pitch attitude must be changed to maintain a constant altitude. The load condition (gross weight) of the aircraft has a definite effect on pitch attitude. At high gross weight, the aircraft flies more nose high than at low gross weight in order to maintain altitude at the same indicated airspeed. This effect is more noticeable at low airspeeds than at high airspeeds. From this, we can see that precision pitch control at high airspeeds and high altitudes demands close attention and smooth control technique. The instruments used for pitch control are the attitude indicator, altimeter, vertical-speed indicator, and to a lesser degree in high speed aircraft, the airspeed indicator.

THE ATTITUDE INDICATOR

The attitude indicator is never used as the primary pitch instrument since it is subject to error. By using the attitude indicator initially to quickly place the nose of the aircraft in approximately the correct position for any desired condition of flight, and then using the remainder of the pitch instruments, small corrections can be made to bring the aircraft to the exact condition of flight desired. It must be remembered that the attitude indicator is subject to precession in a turn. This precession is most noticeable while the aircraft is in a bank or immediately following the roll out of a bank. The error is a minor problem, if the attitude indicator is used with the other flight instruments, making small corrections as necessary.

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There is no lag in the indications of this instrument. For maximum use and accuracy the miniature airplane should be adjusted to be level with the horizon bar at cruising airspeed. When using the attitude indicator to make pitch corrections, use light control pressures, but make positive corrections. Use the vertical speed indicator to determine if you are overcontrolling the pitch attitude, for this will show the "rate" of altitude change. NEVER USE THE ATTITUDE INDICATOR BY ITSELF.

THE ALTIMETER

The altimeter gives an indirect indication of the pitch attitude of the aircraft in level flight. The attitude should remain constant, and any deviation from the desired altitude shows the necessity for a change in pitch. The rate of departure from the desired altitude is an indication of the amount of deviation from the level flight pitch attitude. If the altimeter moves from a desired altitude, you should correct the movement with two distinct changes of attitude: The first is a change of attitude to stop the altimeter, and the second is a change of attitude to return smoothly to the desired altitude. Of course, when you again attain the desired altitude you will have to make another pitch change to level-off and maintain that altitude. Make corrective action promptly with light pressures on the controls to avoid the necessity for larger corrections which will be required if you delay. There is very little lag in the altimeter, however, at high altitudes it may appear to lag occasionally.

THE VERTICAL-SPEED INDICATOR

The correct use of the vertical-speed indicator is essential for precision control of pitch attitude in high speed aircraft. Although it gives an indirect indication of the pitch attitude rather than a

positive indication when you use a smooth control technique, it will positively indicate any change from the desired pitch attitude. When you use light control pressures, the initial movement indicates the "trend" of the vertical movement of the aircraft. Always use the vertical speed indicator in conjunction with the altimeter for level flight, for the vertical-speed indicator operates on the principle of the "differential of pressure" between the pressure inside of the case and that on the outside of the case. This gives it a "built-in" lag. To fly this instrument properly, you need to learn to "lead" this lag, and to "start" it when it is stopped, and to "stop" it when it is started, especially when flying partial panel.

For example, if the altimeter is indicating below cruising altitude, and the vertical-speed indicator is on zero, apply enough pressure to "start" the vertical-speed up--no more. For through the lag in the vertical-speed indicator, a greater attitude change will have been made than this instrument indicates, and if pressure is continued, too great an attitude change will be made, which will result in overcontrolling. When the aircraft has returned to the cruising altitude, forward pressure will be required in order to stop the climb. The amount of pressure necessary will be determined by many things. Mainly, the rate the aircraft is returned to its altitude. If the vertical-speed indicator is still moving up, apply enough forward pressure to stop its upward movement. If it has already stopped, and is steady, apply enough pressure to "start" it moving downward. Then stop, or the nose of the aircraft will be lower than necessary, which will result in another loss of altitude. Just the reverse order of this will be required if the aircraft is above altitude and it is to be returned to cruising altitude.

That is why we say in order to fly the vertical-speed indicator properly: learn to lead its lag; start it when it's stopped; and stop it when it's started. Refrain from using excessive corrections. Depending on the amount of attitude to be gained or lost, it is recommended that moderate amounts of "return" be used--up to 500 feet per minute.

THE AIRSPEED INDICATOR

The old type airspeed indicator gives an indirect indication of the pitch attitude of the aircraft. For any power setting there is one pitch attitude that will hold the altitude and airspeed constant. If the airspeed increases, the nose is too low, and if the airspeed decreases, the nose is too high. The value of the old type airspeed indicator as a pitch instrument decreases with higher airspeeds. At high airspeeds, a 10-knot change in airspeed means an immediate gain or loss of 500 feet or more of altitude. This means that the old type airspeed indicator is of very little value as a pitch instrument at high airspeeds, and it is used primarily in level flight for the control of power. However, in aircraft equipped with the new type airspeed indicator, which is known as the sensitive airspeed indicator, there is a window showing an airspeed range from 0 to 100 knots, and it is calibrated in 2-knot increments. This instrument is a valuable aid in pitch as well as in power control, because of its sensitivity and small calibration.

TURNS--ENTRY, TURNING, AND RECOVERY

The true airspeed determines the angle of bank necessary to maintain a given rate of turn. As the airspeed increases the bank must be increased if the same rate of turn is to be maintained. If the airspeed

is decreased, the bank must be decreased if the same rate of turn is to be maintained. At 150 knots true airspeed, approximately 22° of bank will be required to maintain a coordinated standard rate turn (3° per second), while at 350 knots true airspeed, the required bank to maintain this rate of turn will be approximately 45° . To avoid steep banks in high speed aircraft where more than 30° of bank is required to maintain a standard rate turn, a $1/2$ standard rate turn is used ($1\ 1/2^{\circ}$ per second). The method a pilot uses to roll in and out of a turn properly, maintaining altitude and airspeed, is termed "pilot technique." I have no intentions of attempting to establish an ironclad method for this technique, but I will endeavor to point out common mistakes during the performance of this maneuver.

To enter a turn, apply steady coordinated pressures on the stick and rudder in the direction of the desired turn. As soon as you apply pressure, the attitude indicator becomes the primary bank instrument. When you have established the approximate desired angle of bank, the turn needle then becomes primary for bank. In a level turn, as in straight and level flight, the altimeter becomes the primary pitch instrument. When entering a turn, the pitch attitude must be increased in order to increase the lift to compensate for the loss of vertical lift caused by the banking of the aircraft. If this is not done, the result will be a loss of altitude. As you raise the nose of the aircraft to hold the altitude, power must be added to maintain the airspeed (for when you raised the nose to increase the lift in order to maintain the altitude, drag was also increased, necessating the increase in power).

upon rolling out, the nose will have to be returned to the level flight attitude, and the power decreased to normal cruise for the altitude and airspeed. Common faults of this maneuver are: gain altitude on the roll-in; loss of altitude in the turn; loss of airspeed in the turn; tendency to overbank; bank not constant; and a gain of altitude on the roll out.

Now let us look at the entire maneuver. To roll into a turn, apply even pressures to the stick and rudder in the direction of the turn (if you have a tendency to gain or lose altitude on the roll-in, it is usually caused by one or both of two things--providing the aircraft has been properly trimmed for straight and level flight--you are tense and have a "death-grip" on the stick and/or are applying unnecessary pressures on the stick at the beginning of the roll-in). About half way into the bank, increase the power to maintain the airspeed, applying slight back pressure on the stick to raise the nose. As the bank becomes established "top-stick" may be required, depending on the degree of bank, to keep the aircraft from overbanking (overbanking tendency usually increases from 30° to 45° and decreases from 45° to 60°). Upon rolling out, begin applying forward pressure on the stick to lower the nose about half way through the roll out, reducing power to normal cruise for the altitude and airspeed. With practice, using this or a similar technique, turns can be successfully completed.

CLIMBS AND DESCENTS

The importance of developing proficiency in executing these maneuvers is emphasized by the fact they are used during the portions of the flight which required maximum precision. As examples: GCA's, Low Approaches,

Missed Approaches, etc. Regarding aircraft control, smooth changes in pitch and bank attitudes are best accomplished by reference to the attitude indicator, while smooth power control is largely a matter of pilot technique, assisted by the tachometer.

CLIMBS AND DESCENTS AT A DEFINITE RATE

These maneuvers consist of performing a climb or descent while maintaining both a constant predetermined airspeed and rate of vertical speed. Normally, a vertical speed of 1000 feet per minute is used for practice purposes.

ENTERING AND MAINTAINING A CONSTANT RATE CLIMB OR DESCENT

During the first portion of the entry, before the vertical speed indicator stabilizes, you should select the power setting and pitch indications that will provide the desired vertical speed and indicated airspeed. When the vertical speed indicator approaches the desired rate, it replaces the airspeed indicator as the primary pitch instrument. At this time adjust the pitch attitude to maintain the desired rate of climb or descent. At the time the vertical speed indicator becomes primary for pitch control, the airspeed indicator becomes primary for power control; therefore, adjust the power to maintain the desired airspeed. If using the clock, keep the clock and the altimeter together to maintain 1000 ft. per minute climb or descent.

CLIMBING AND DESCENDING TURNS

Climbs and descents in turns combine the techniques used in straight climbs and in descents with those used in level turns. Begin the climb or descent and the turn simultaneously.

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B STAGE -- BASIC INSTRUMENTS

SYL PERIOD

AIRCRAFT

DUAL/SOLO

STUD-INSTR RATIO

DESCRIPTION

HOURS
FLIGHT

Objective. The objective of the basic instrument stage is to prepare the student pilot with the necessary basic instrument flying skills to move on successfully to more difficult tasks during the instrument navigation stage.

NOTE: All flights are dual. Student hooded. One basic instrument flight will be flown at night. Partial panel refers to flight utilizing the standby attitude indicator.

B-1

TA-4J

DUAL

1-1

1. Review cockpit procedures, check list, etc. 1.4
Student copy and read back simulated instrument clearance, tune radies.
2. Student perform instrument take-off (instructor assist as necessary). Student accelerate to climb schedule and perform climbing turns to altitude. (Calibrate turn needle).
3. Demonstrate level-off technique.
4. Student practice:
 - a. Level flight and pitch control.
 - b. Turn entry and roll-out.
 - c. Speed changes in level flight (emphasize use of trim).
5. Instructor demonstrate, student practice:
 - a. Aileron rolls.
 - b. Turns and reversals.
 - c. Wing-overs.
6. Student practice vertical S-1 pattern.
7. Student perform penetration pattern (clean) as described in the FTL.

B-2

TA-4J

DUAL

1-1

1. Student perform cockpit procedures, check list, etc. Student copy and read back simulated instrument clearance, tune radies. 1.4
2. Student perform instrument take-off, climb, and level-off.

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SYL PERIOD AIRCRAFT DUAL/SOLO STUD-INSTR RATIO	DESCRIPTION	HOURS FLIGHT
	3. Student perform: <ul style="list-style-type: none"> a. Level flight. b. Turns and reversals. c. Speed changes. d. Vertical S-1 pattern. 	
	4. Student practice vertical S-2 pattern.	
	5. Instructor introduce, student practice, instrument flight with AJB-3A failure (partial panel).	
	6. Student perform (partial panel): <ul style="list-style-type: none"> a. Vertical S-1 pattern. b. Turns and reversals. 	
	7. Student perform: <ul style="list-style-type: none"> a. Aileron rolls and wing-overs. b. Penetration pattern (clear). 	
R-3 TA-4J DUAL 1-1	1. Student perform cockpit procedures, check list, etc. Student copy and read back simulated instrument clearance, tune radios.	1.4
	2. Student perform: <ul style="list-style-type: none"> a. Instrument take-off. b. Climbing turns and reversals to altitude. c. Level-off technique. d. Vertical S-2 pattern. e. Vertical S-3 pattern. f. Aileron rolls and wing-overs. 	
	3. Student perform vertical S-2 pattern (partial panel).	
	4. Instructor demonstrate, student practice, unusual attitude recoveries (full and partial panel).	
	5. Student perform dirty penetration pattern.	

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SYL PERIOD

AIRCRAFT

DUAL/SOLO

STUD-INSTR RATIO

DESCRIPTION

HOURS

FLIGHT

B-4

TA-4J

DUAL

1-1

1. Student perform cockpit procedures, check list, etc. Student copy and read back simulated instrument clearance, tune radios.
2. Student perform:
 - a. Instrument take-off.
 - b. Climbing turns to altitude (partial panel).
 - c. Vertical S-3 pattern (full & partial panel).
 - d. Unusual attitude recoveries (full & partial panel).
3. Instructor demonstrate, student practice, approaches to stall. (Emphasize minimum loss of altitude.)
4. Student perform clean penetration pattern (partial panel).

1.4

B-5

TA-4J

DUAL

1-1

1. Student perform cockpit procedures, check list, etc. Student copy and read back simulated instrument clearance, tune radios.
2. Student perform:
 - a. Instrument take-off.
 - b. Climbing turns to altitude (partial panel).
 - c. Approaches to stall.
 - d. Vertical S-2 and S-3 patterns (full & partial panel).
 - e. Unusual attitude recoveries (full & partial panel).
3. Instructor demonstrate, student practice:
 - a. Split-S (not to be performed at night).
 - b. Loops and half-Cuban eights (not to be performed at night).
4. Student perform:
 - a. UIIF/DF steer and penetration to home field (partial panel).
 - b. Missed approach (partial panel).

1.4

B-6

TA-4J

DUAL

1-1

1. Student perform cockpit procedures, check list, etc. Student copy and read back simulated instrument clearance, tune radios.

1.4

NAVTRAEQUIPCEN IH-207

SYL PERIOD	AIRCRAFT	DUAL/SOLO	STUD-INSTR RATIO	DESCRIPTION	HOURS FLIGHT
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2. Student perform:

- a. Instrument take-off.
- b. Instrument departure to altitude.
(Instructor may issue instrument departure clearance of his choice.)
- c. Vertical S-3 patterns (full & partial panel).
- d. Aileron rolls and wing-overs.
- e. Unusual attitude recoveries (full & partial panel).
- f. Approaches to stall.
- g. Penetration pattern.

3. Student's basic air work must merit advancement to instrument navigation stage.

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APPENDIX C

QUALITATIVE ASSESSMENT

APPENDIX CQualitative Assessment

By completing the Qualitative Assessment Checklist (QAC) an attempt is made to record the characteristic features of the device and user judgments about their contribution (or lack of it) to effectiveness.

Qualitatively, evaluation consists of examining the procedures used for training in terms of specified objectives and examining device design in terms of its capabilities to implement those procedures. At this level of evaluation, data is gathered from documentation review, interviews with training and operational personnel and observation of training. Based on these data about the device and its use, limited conclusions can be drawn about the "effectiveness" of the device. The rationale for drawing conclusions on this basis is that if the training conducted in the device has these features; specified training objectives, sufficient structure and control and feedback based on objective measurement, then it is "more effective" than if it does not have them.

The output of a qualitative evaluation consists of identified deficiencies in design and/or training practice and recommendations for their improvement. It can be seen from the preceding discussion of qualitative assessment that the conclusions about effectiveness are based on logical grounds or, at best, on the application of criteria that represent the state-of-the-art in training technology.

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QUALITATIVE ASSESSMENT CHECKLIST

TD No. 2F90 TD Name TA-4J CFT
 Where visited NAS, KINGSVILLE, TX Other locations CHASE FIELD, BEE-
 VILLE, TX., MERIDIAN, MISS
 Observer J.A. PUIG Date 12-9-70

GENERAL DESCRIPTIVE

1. Responsible activity CNAVANTRA
2. Counterpart conventional training? None
3. Purpose of training
 - a. Level of training School, course, and refresher -
 advanced and transition.
 - b. Personnel to be trained Advanced student pilots who
 operational experience and fully qualified naval
 pilots for transition to jet and refresher instr. train.
 - c. Functions to be trained Cockpit procedures (including
 emergency procedures) field and carrier approach,
 landing procedures, and limited mission execution
4. Trainee population
 - a. Input source(s) Basic Training Command and Fleet.
 - b. Scheduling 9 to 11 new students (plus 2 or 3 transition/
 refresher for instructors or fleet) total of about 41
 or 42/month. Min. of 53 hrs. 1stcd. in training.
 - c. Entrance requirements Completion of all Basic
 Training Command requirements.

QUALITATIVE ASSESSMENT CHECKLIST-

DESIGN

1. Fidelity of Simulation - Trainee Stations

- a. Operational environment simulated TA-4J aircraft; geogr covers Tex. (except far west) & southern & central Fla; navigational aids over this area. Program chgs (tapes) will be made to simulate any area in U.S.
- b. Number of mockups Four TA-4J cockpits per trainer.
- c. Number of trainee stations Four per trainer.
- d. Nature of simulation Digital (& analog conversion) & 100 Data Systems, two general purpose SIGMA 5's.
- e. Control/display dimensions simulated All front seat instrumentation (complete cockpit simulation). No radar.
- f. Correspondence of simulation characteristics with operational extremely good fidelity with control 'feel' and flight characteristics similar to aircraft.
- g. Correspondence of mockup layout "one-to-one" except for lack of matting on side walls.
- h. Correspondence of target characteristics N/A.

2. Design for Utilization - Instructor's Console (IC)

- a. Control features - manual aircraft parameters (e.g. environment, stores, etc.) malfunction insertions.
- b. Control features - auto/adaptive Malfunctions can be inserted to occur at specified points or time in the future. A max. of 3 malfunctions can be inserted at same time or prior to beginning of mission.

QUALITATIVE ASSESSMENT CHECKLIST -

DESIGN

- c. Monitoring features Flt. path recorder, two 4-channel strip recorders can monitor any 8 of 18 mission segments; teletypewriter; tape recorder.
- d. Features for trainee KR Operational feedback from displays on panels & voice communication w. instructor
- e. Critique-playback capability Recorder cabinet has plotter (flight path recorder) and two 4-channel strip recorders. Instructor console also has an audio tape recorder.
- f. Measurement capability-manual Repeat displays at instructor station.
- g. Measurement capability-auto Flt. path and strip recorders. Computer printout on teletypewriter will record errors (e.g., altitude & speed, etc.) however, it does not indicate amount of error; nor does it indicate when malfunctions are inserted or when the problem is made more difficult (e.g., buffeting increased).
Instructor or analyst is needed to monitor 'traps' for proper interpretation. Computer will record errors but does not indicate conditions under which they occurred. Errors on teletypewriter will be recorded as system. the tolerance limit is specified, however, it will not record if the pilot performance remains out of tolerance. Therefore, a good student who attempts

QUALITATIVE ASSESSMENT CHECKLIST

g. Measurement capability-auto (Cont)

to maintain proper conditions will record more errors than one who does not. However, a good instructor will not permit the trainee to remain out of tolerance for more than about one minute.

Data from strip-chart recordings is not amenable to easy interpretation. It would require several hours to analyze the chart to provide feedback to instructor and student. Means to digitize data for automatic scoring is needed.

QUALITATIVE ASSESSMENT CHECKLIST

UTILIZATION

1. Schedule

- a. Utilization rate 125% based on an 8 hr day (10 to 12 hrs) (Sept. & Oct. 1970) Probably about 110% when leveled out.
- b. Course Pdr. Jt. Fld. Trng. Prog. Duration 20 weeks (6 weeks. turned)
Device use 53 hrs. min to as much as twice that per stud.
- c. Class loadings Average 10 advanced studs. & 2 transition studs. 50 classes or 500 studs per yr
- d. Refresher scheduling Transition students & instructor pilots on board (from squadron) every quarter.

2. Instructor Requirements

- a. Number One instructor per cockpit. Total of 24 (17 TRADESMEN & 7 civilians).
- b. Qualifications/Background Experience ranges from two weeks to about 8 yrs. Some of the civilian instructors have had flight experience.

3. Content

- a. Course materials NAVJIT syllabus for TA 41, Emergency Procedures syllabus for TA-45 (NAVJIT is not restricted for transition students).
- b. Refresher materials Emergency procedures syllabus, portions of.

4. Problem Design

QUALITATIVE ASSESSMENT CHECKLIST

UTILIZATION

- a. Problem sources Developed by CNAVANTRA with additions from squadron and training personnel
- b. Training objectives Emergency Procedures (EP) syll. for proficiency in emergency procedures. NAVJIT syllabus for TA-4J. Objectives are specified by above but modified to some extent by individual instructors
- c. Problem difficulty Sequenced according to difficulty.
- d. Other variables Different navigational routes may be followed. Not defined in syllabus and chosen by instructors.
- e. Problem update None on day-to-day basis. Syllabus may be changed at intervals by committee action.

5. Conduct of Training

- a. Pre-problem briefing Approx. 15-minute briefing on general discussion of material to be covered.
- b. Problem exercises Profiles are programmed; other flights are made at the discretion of the instructor.
- c. Post-problem critique Approx. 15-minute by instructor. Discussion of notes instructor took during run and flight plotter, and teletype information used on profiles.
- d. Problem sequencing Based on syllabus and partially on student performance. Re-runs may be given at weak performance points (over at trainers request).

QUALITATIVE ASSESSMENT CHECKLIST

UTILIZATION

6. Measurement

- a. Pretest Requirements for entering advanced training.
- b. Performance measurement Grades on each step by instructor. Grade sheets are kept in student's Training Jacket (ATJ) and may be compared with flight grade sheets which are the identical form.
- c. Performance records The following grade sheets are kept in ATJ: CNATRA-GEN 1542/36 GCA; 542/51 Basic Instruments; 1542/52 Radio Instruments; 1542/54 Instrument Check/X-C Navigation; 1542/59 PAT.

7. Feedback

- a. Trainee feedback During problem and post problem instructor discusses performance with student.
- b. Feedback to unit Performance records on trainee are available to squadrons. Training Department compares training records with squadron flight records and generally have found a high positive correlation.

Qualitative Analysis

Based upon the qualitative assessment of Device 2F90, the following preliminary observations were made:

- a. Device 2F90 appears to be a high-fidelity trainer and is well accepted by both students and instructors (see item 'f' under 'Design' in QAC).
- b. The device has automatic measurement capability but the usefulness of the output data, in its present form, is doubtful (see item 'g' under 'Design').
- c. Utilization - Training in the device is limited to the B and C stages (Basic Instrument and Instrument Navigation) for lack of a visual display system.
- d. The overall impression, gained from performing the qualitative assessment, is that Device 2F90 has high content validity and there is a high probability that training is positively transferred to the TA-4J Aircraft.
- e. Operational and user personnel have made the following recommendations:
 - (1) Device instrumentation for performance measurement requires modification in order to provide rapid and easily interpretable feedback for instructor and student debriefing.
 - (2) The ejection handle in the trainer cockpit is difficult to reset. It should be spring-actuated ("like a window shade") for easy reset.
 - (3) A visual system that would permit the trainer to be utilized in the A, F, G, and L stages as well as extending the simulator training in the B and C stages.